Transportation Master Plan
For The Greater Texas Medical Center Area

Technical Memorandum 2

NEEDS ASSESSMENT

Prepared for

The City of Houston

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1. INTRODUCTION

This memorandum describes current and future needs identified for traffic, transit, parking, pedestrians and bicycles. The needs were determined based on information obtained from reports of previous studies, the study team's observations, and stakeholder interviews.

2. INTERVIEW SUMMARY

A total of 25 interviews were conducted with key stakeholders identified by the City of Houston as well as others who were identified during the interviews. Appendix A1 lists the persons interviewed. The following topics were covered during the interviews:

- plans to develop or redevelop any land or to improve transportation facilities or services in the area;
- stakeholder information on transportation conditions in the study area;
- stakeholder mobility and accessibility objectives for the study area;
- perceived transportation-related deficiencies and needs (both short and long-term);
- suggested improvements; and
- any other inputs or comments.

Appendix A2 contains a summary of the interviews, showing the identified issues, opportunities, and proposed projects.

3. NEEDS ASSESSMENT

3.1 Traffic

3.1.1 Traffic-Related Needs

Numerous traffic-related needs were identified during the stakeholder interviews and through observations made by the study team. These needs can be categorized as accessibility, flood control, future developments, and neighborhood considerations. The following is a summary of these needs:

<u>Accessibility</u>

The layout of the study area is such that accessibility will remain an important challenge, particularly to and from the Texas Medical Center (TMC), which is the largest major traffic generator on a regular basis. Accessibility to the TMC and other area developments is hindered by fairly impenetrable land uses such as Rice University to its west and Hermann Park to its north. Additionally, the lack of a proper grid shaped road network and the barrier effect created by Brays Bayou make accessibility to the area facilities more challenging. Apart from the TMC, a need was also identified to improve accessibility to Reliant Park.

The following are the specific study area accessibility-related needs identified through the stakeholder interviews:

- Improve access from freeways such as IH-610 and SH-288 to the TMC area.

- The signage along SH-288 and US59 needs improvement to guide drivers to the appropriate access points and to help manage the distribution of traffic.
- There is a need for improved east-west connections along the South Main street corridor.
- Access to Reliant Park needs to be improved.

Flood control

Street flooding in the study area is a major concern for general traffic and particularly for emergency vehicles. To alleviate some of this problem, the Brays Bayou will be enlarged 17 miles from its mouth all the way to Fondren Street (about five miles west of the study area). This project includes flood channel widening on one or both sides of the bayou and raising all bridges above 100-year flood plain level. In the study area a total of nine bridges will be affected. Bridges to be modified or replaced include Ardmore, SH-288, Almeda, S. Braeswood, Fannin (currently being replaced), Greenbriar, S. Main, and Kirby. Bridges at Holcombe and Buffalo Speedway need lengthening. This reconstruction provides several opportunities to build a number of signature bridges, or to move the location of some of the bridges, or to otherwise enhance them (e.g., add bike lanes, improve pedestrian accommodations). It is expected that SH-288 will be reconstructed over Brays Bayou to raise the bridge. This will provide opportunities to improve frontage road, cross-street bridge, and interchange configurations influencing road designs near Brays Bayou Bridge.

Future developments

It is anticipated that the activity centers in the study area will all grow in population and hence traffic impact over the next several decades. The increased traffic impact will result in a need for new or improved transportation infrastructure. The extent of growth, however, will be different for the various activity centers. The following is a brief summary of what can be expected:

- The Almeda corridor redevelopment will be focused on localized revitalization and redevelopment and is not expected to generate a significant increase in traffic impact.
- Rice University has appointed consultants to prepare a master plan for development on the western side of the campus. It is unclear at this stage whether there will be a significant expansion;
- The TMC will have a significant growth over the next few decades (estimated 50 percent growth in employees). Much of this growth will occur to the south of Brays Bayou and Holcombe. For example, the TMC sees the need for one or possibly two new trauma centers. The location of these centers is of prime concern. They should be highly accessible, yet integrated with the current facilities of the TMC. The planned BioTechnology Park is a large (2 million square feet) development south of Old Spanish Trail that will be developed in phases over a 20-year period.
- The development at Reliant Park is of a balanced nature (parking and traffic will be better integrated into the development). It is also expected that the total floor space of the final development will not be significantly more than what was there before. It, therefore, is not expected that there will be a significant increase in the magnitude traffic impact. However, the upgrading and modification of facilities is expected to increase the frequency of events of all sizes at Reliant Park. The Astroworld, which leases 5,000 parking spaces from Reliant Park, could be a future site for expansion of Reliant Park.

- It is anticipated that development at Hermann Park and the Museum District will not be of a significant nature. Any additional development in these areas could, however, have a considerable traffic and parking impact during high volume days.

Neighborhood considerations

The neighborhoods in and around the study area are challenged by many traffic-related issues. Pedestrian safety, short-cutting, excessive noise and air pollution, expropriation of private property, and barriers created by major transportation facilities are some of the issues facing these neighborhoods. The following are some specific needs identified through the interviews:

- traffic short-cuts through neighborhoods west of Main;
- Greenbriar and Shepherd south of US 59 experience traffic speeds that are far too high for a residential area;
- the completion of West Bellfort to US 59 requires a road to be built between Stella Link and Buffalo Speedway. This would increase traffic through the neighborhood west of Stella Link, which is opposed by neighborhood;
- SH-288 is a barrier that splits a former neighborhood. Cross connections should be provided.

3.1.2 Intersection Analysis

Intersections are the most critical points in a transportation network because congestion starts at these points. A level of service (LOS) analysis is a useful technique to determine how well intersections and, therefore, the transportation network in general, is functioning. Typically, in traffic studies, existing conditions are analyzed for the A.M. and P.M. peak traffic hours using turning movement counts for the intersections to determine peak hour operating conditions. Unsignalized and signalized intersection operations can be analyzed using procedures found in the *Highway Capacity Manual*.

Results of the capacity analyses are reported in standard LOS format, with the most favorable conditions being designated as LOS A and the poorest conditions (e.g., congestion) shown as LOS F. Intersection level of service is based on the average amount of delay that a each vehicle encounters at a given intersection. The LOS criteria for signalized intersections, along with a brief description of the conditions experienced for each LOS grade, are shown in Table 1**.**

Transportation agencies generally consider operations at or above LOS C to be acceptable. Depending upon the location, operations at or above LOS D may also be considered acceptable during peak traffic hours. For a high activity area like the study area, LOS D is considered acceptable.

TABLE 1: Level-Of-Service Criteria for Signalized Intersections

Level of Service	Stopped Delay (sec/veh)	Description
A	[< 10	At a single intersection most vehicles do not stop at all. When linked with other signals, vehicles progress through intersections without stopping.

Level of Service	Stopped Delay (sec/veh)	Description
B	> 10 and [< 20	At a single intersection some vehicles stop before getting a green signal. When linked with other signals, some cars may have to stop but most progress through the intersection without stopping.
C	> 20 and <[35	At a single intersection, a significant number of vehicles must stop and wait for a green signal. Some vehicles may have to wait through one full signal cycle before being able to move through the intersection.
D	> 35 and <[55	At this level, congestion is noticeable. Many vehicles have to stop while waiting for a green signal. A noticeable number of vehicles have to wait through one full cycle before being able to continue through the intersection.
E	> 55 and <[80	At this level, almost all vehicles have to wait through one or more full signal cycles before moving through the intersection. When linked with other signals, progression is slow.
F	> 80	At this level, the number of vehicles entering the intersection exceeds its capacity. Vehicles have to wait through multiple full signal cycles before moving through the intersection.

After reviewing the previous studies conducted in the study area, existing levels of service for intersections for which data was available within the study area were collected. Figure 1 shows the worst cases. It should be noted that data was not available for all intersections in the study area and the effort was focused on the core of the stud area. Additionally, the levels of service indicated in the figure are for the overall intersection and not for each turning movement individually. For example, an intersection may operate at LOS C or D and still have movements operating at higher or lower levels of service. Also, it should be noted that some of the level of service analyses are based on volumes dating back as far as to 1995 and therefore, operating conditions could be significantly worse at this time.

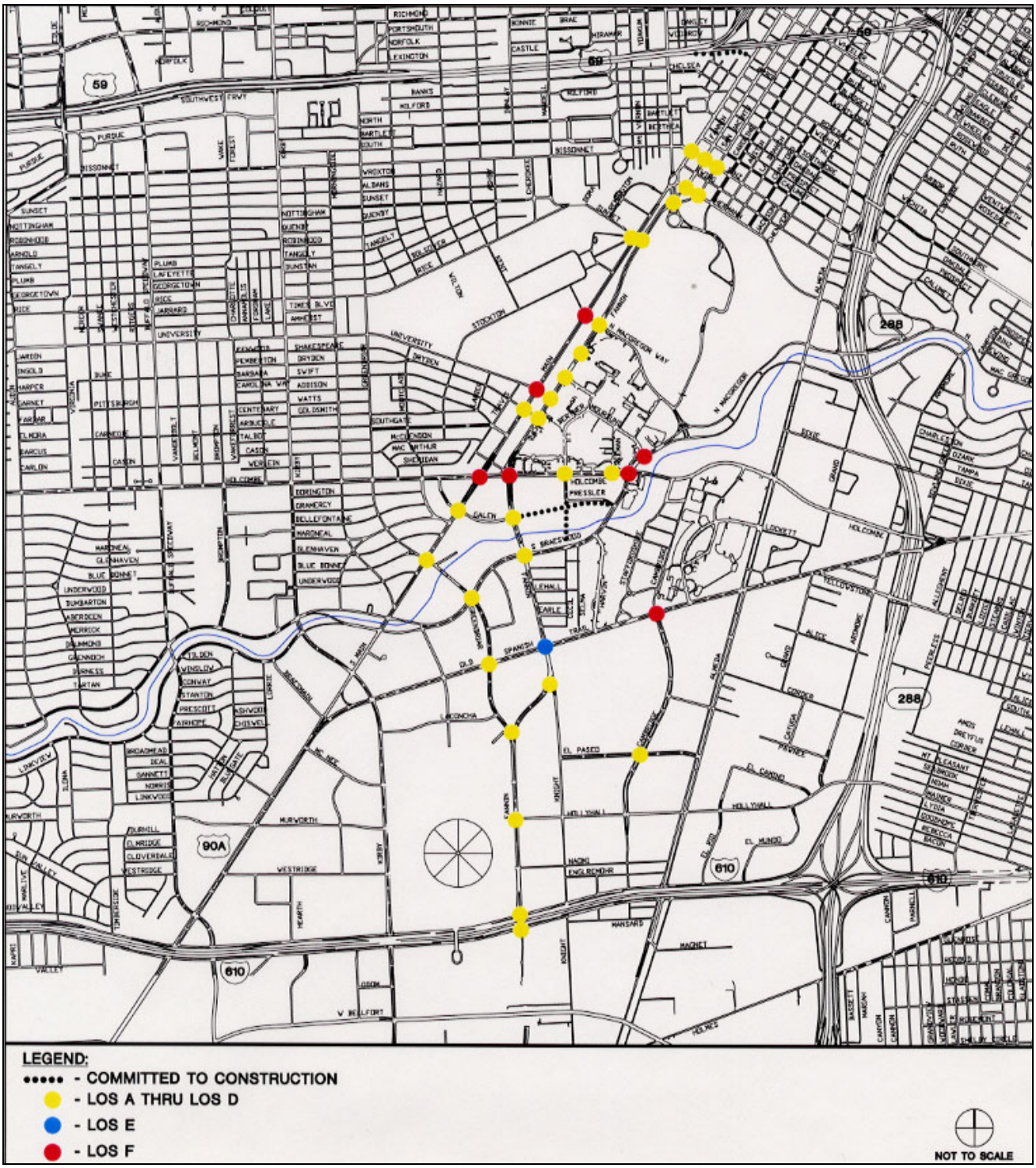


FIGURE 1: Existing Peak Hour Level of Service

As shown in Figure 1, there are significant capacity deficiencies at the following intersections:

- Fannin at Old Spanish Trail;
- Cambridge at Old Spanish Trail;
- Main at Holcombe;
- Fannin at Holcombe;
- Main at University;
- Main at N. MacGregor;
- Holcombe at MacGregor; and
- Moursund at MacGregor.

The street system serving the area has almost the same number of lanes as it did when the medical center was half of its current size. Although the streets system has not been expanded over that time (except main Street widening south of Old Spanish Trail), the projected growth of TMC and other area facilities will compound these deficiencies. The number of intersections operating at LOS E or LOS F should increase significantly unless the roadway system is improved.

To improve traffic operations at the intersections where capacity deficiencies exist, or are anticipated, a combination of modifications are needed. The following is a list of general modifications that can improve operations:

- construct left or right turn lanes where turning movements are high (and utilize double turn lanes where turns are especially high);
- improve network connectivity;
- widen existing roadways;
- construct additional parallel roadways to relieve existing major thoroughfares;
- promote alternate modes of transportation instead of the single occupancy vehicle; and
- construct grade separations.

3.1.3 Future Needs

An assessment of future roadway system needs was made using projections made by the Houston-Galveston Area Council (HGAC) for conditions anticipated in 2025. The traffic projections are based on land use, population, and employment estimates by zone for the Houston-Galveston region. Input from landowners, businesses, and others are used along with statewide and local economic projections to arrive at population and employment estimates. A review of the estimates for the study area showed that they appear to be at the correct order of magnitude for when they were developed. Some changes have occurred in projected employment for the TMC and proposed Biotechnology Park, but it is expected that these increases in projected growth will only slightly change (increase) the forecasts for 2025. To properly reflect the increases without re-forecasting regional growth by zones, the study team has adopted a posture of using conservative figures in analyses of traffic. Phase 2 of the study will include a more detailed travel model for the study area and will address demographic changes from prior estimates.

HGAC estimates of future traffic volumes were prepared for a typical weekday 24-hour period. These estimates were prepared using a computer travel modeling process. Estimated weekday volumes are shown in Figure 2. Most of these volumes represent increases over current volumes. Figure 2. also shows the number of traffic lanes projected to be in place on the thoroughfare system under the region's 2025 plan.

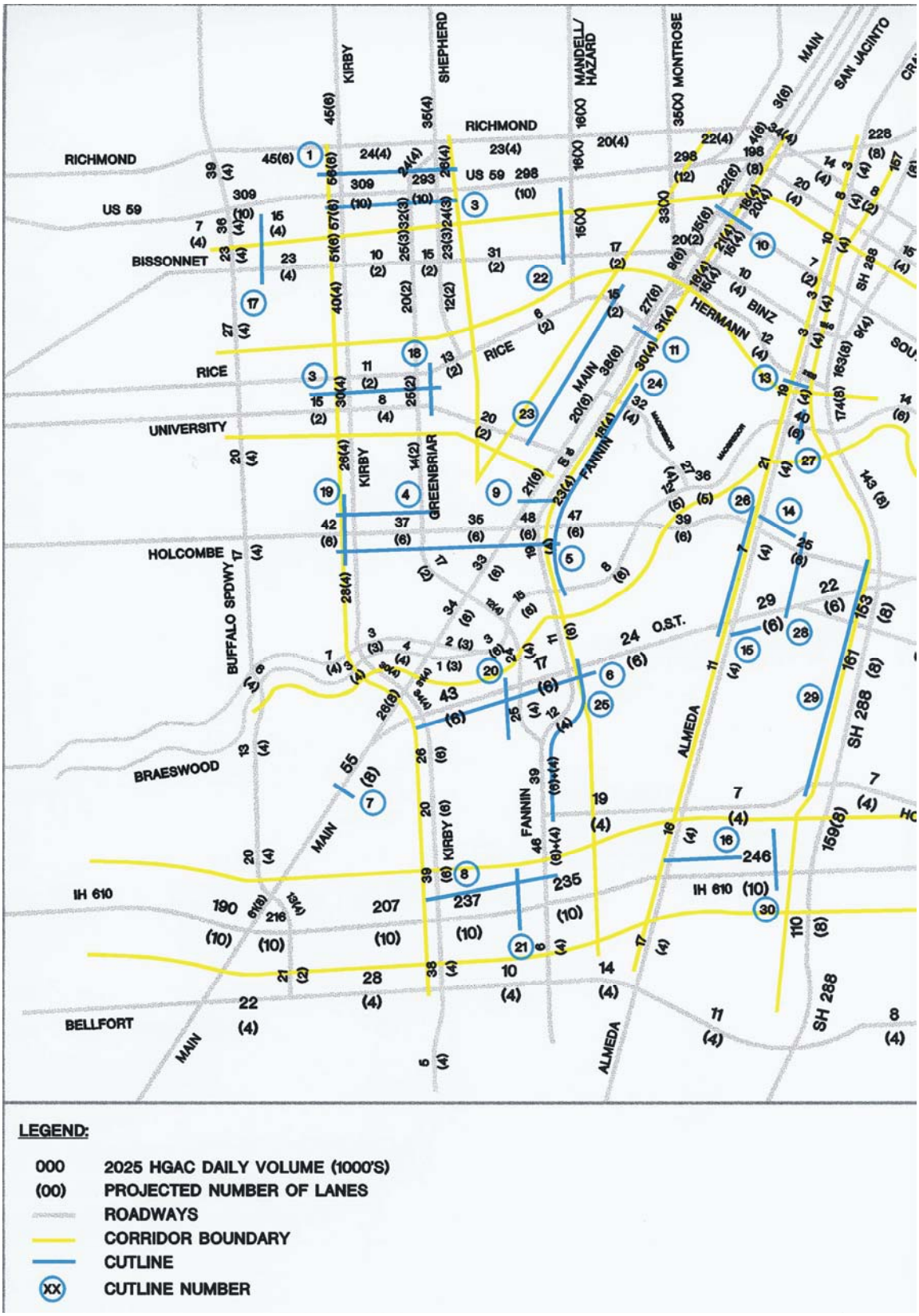


FIGURE 2: Estimated 2025 Weekday Traffic Volumes (show also corridors and cutlines)

A corridor cutline capacity analysis was performed for roadways throughout the study area. This consisted of summing demand volumes for parallel routes serving the same areas and then comparing demand volumes to available service volumes (maximum volume at LOS (LOS) D). The service volume used for LOS D was 7,000 vehicles-per-day per average through lane since the available demand volumes were already capacity constrained. This daily average lane capacity is based on intersection capacity with typical left turn percentages, peak hour volumes being 8 percent of daily volumes, and an approximately even split of signal green time for each of two intersecting arterial streets. This also assumes that each street in the corridor group can be fully utilized to its maximum service volume. Lanes needed to adequately serve each set of parallel roadways was determined by dividing the total demand volume by the daily service volume per lane. Table 2 contains the findings from this analysis. Through lane capacities will be sufficient to meet demands in most cases, but deficiencies will exist at some cutlines. These deficiencies will range between two and six lanes.

TABLE 2: 2025 TRAFFIC LANE NEEDS ASSESSMENT

Cutline	Projected Daily Volume (1000s)	Through Lanes	Service Volumes	Through Lane Deficiency
1	106	14	98	2
2	113	12	84	6
3	55	6	42	2
4	40	6	42	-
5	97	16	112	-
6	63	14	98	-
7	55	8	56	-
8	85	14	98	-
9	44	10	70	-
10	51	14	98	-
11	68	10	70	-
12	38	10	70	-
13	19	4	28	-
14	21	4	28	-
15	11	4	28	-
16	16	4	28	-
17	25	6	42	-
18	33	4	28	2
19	42	6	42	-
20	43	6	42	2
21	237	10 fwy	200	2
22	31	2	14	4
23	26	4	28	-
24	87	16	112	-

Cutline	Projected Daily Volume (1000s)	Through Lanes	Service Volumes	Through Lane Deficiency
25	43	10	70	-
26	63	12	84	-
27	40	6	42	-
28	54	12	84	-
29	74	20	140	-
30	246	10 fwy	200	4

The assessment shows that by 2025 there will be a need for approximately 4-6 additional lanes in the north-south direction and 4 lanes in the east-west direction. These additional lanes would need to be continuous to avoid congesting additional intersections with increased turn movements. They would also need to serve the areas in which the deficiencies are noted.

The location of north-south lane needs, based on demand volumes, is primarily west of Main Street. However, both development and street right-of-way limit the potential to provide additional lanes. This will result in continued heavy traffic and some congestion west of Main unless some north-south traffic can be attracted away from the Shepherd-Greenbriar-Montrose corridor. One possibility might be to encourage drivers using US 59 to use Main Street rather than Shepherd-Greenbriar. This will be partially facilitated when the planned eastbound US 59 exit ramp to Main Street is completed (although its westbound counterpart entrance ramp already exists).

Another possibility would be to promote increased use of streets east of Main. While excess capacity does not exist there except along Almeda, there are opportunities to develop increased capacity east of Main. North-south capacity east of Main is limited by the presence of Hermann Park, TMC, and Reliant Park. Existing access to IH-610 is also limited east of Fannin since no street between Fannin and Almeda cross IH-610 and since there is no access to and from the east at Almeda. Hence, although there are a number of north-south streets that exist and could be widened, the lack of continuity limits the utility of several to meet the needs for access to/from the central portions of the study area. It may be that some access to IH-610 will have to use a combination of east-west and north-south roads. It should also be noted that the street system in the southeast portion of the study area has poor freeway access and many streets that are discontinuous. This has limited the development of this area. Additional access and continuity will be needed if this area is to fully develop/redevelop.

East-west streets throughout the study area are also limited in continuity. It is unlikely that the constraints between Binz and Holcombe will permit additional continuous capacity across the area. South of Holcombe only Braeswood-MacGregor (crosses Holcombe) provides east-west continuity north of IH-610. This forces much of the east-west traffic to use Holcombe (and Old Spanish Trail east of SH 288) and IH-610 for trips of significant distance. Development of additional continuous east-west capacity will require widening existing streets and/or creating new continuity by linking sections of existing streets.

Projections also show that US 59 and IH-610 will be over capacity by 2025. SH 288 will be operating very close to capacity by then. Although there is space available along SH 288 for additional lanes between US 59 and IH-610, sufficient connections to adjoining sections of SH 288, IH-610, and US 59 would also have to be developed; these sections are more constrained. The capacity deficiencies on US 59 and IH-610 will create additional pressure on east-west streets for additional capacity.

A similar approach was used to evaluate intersection operations. Table 3 contains a list of intersections that the traffic volume forecasts indicate are subject to future congestion. Analyses of improvement options in subsequent tasks will consider measures to address arterial lane requirements and intersection needs. Table 3 also lists several intersections that are projected to be satisfactory in 2025 for average day conditions but will be impacted by event traffic generated by Reliant Park and need additional capacity. Finally the table also lists interchanges that are expected to need additional capacity to accommodate turn movements between IH-610 or SH 288 and crossing arterial streets.

TABLE 3: Anticipated 2025 Capacity Deficient Intersections

Intersection	Daily Approach Volumes (1000s)	Approach Through Lanes	Service Volumes	Approach Lane Deficiencies
Holcombe-Kirby	62	10	70	Turn lanes
Holcombe-Greenbriar	52	8	56	Turn lanes
Holcombe-Main	NA*	8	NA*	Turn lanes
Holcombe-Fannin	NA*	8	NA*	Turn lanes
Holcombe-MacGregor-Braeswood	--	12	--	Turn lanes
Bissonnet-Shephard	41	4	28	2
Bissonnet-Greenbriar	37	4	28	2
University-Greenbriar	34	5	35	At capacity
MacGregor-Fannin	56	8	56	At capacity; LRT impact
MacGregor-Braeswood	38	7	35	1
MacGregor-Almeda	58	8	56	1
Main-Kirby	61	8	56	1
Also, due to Reliant Park peak event traffic and freeway interchange patterns				
IH-610-Main	NA*	16	NA	Turns
IH-610-Fannin	NA*	8	NA	Turns
SH 288-MacGregor	NA*	11	NA	Turns
SH 288-Holcombe/Old Spanish Trail	NA*	NA	NA	Turns
SH 288-Holly Hall	NA*	8	NA	Turns
Holly Hall-Fannin/Knight	NA*	6/8	NA	Events

* - NA designates intersection type (grade separation) for which projections do not provide sufficient detail to analyze capacity; evaluation based on overall volumes and current conditions

Above and beyond any capacity considerations, additional north-south and east-west street continuity is needed to (1) provide access to developing and redeveloping areas, and (2) to avoid excessive turns at existing intersections. This need will be addressed in subsequent tasks.

3.2 Transit

This section documents deficiencies in existing transit services and needs for new or expanded transit services as identified during the stakeholder interviews and through field work within the study area.

3.2.1 Stakeholder Interviews

The following transit system needs were expressed during the stakeholder interviews:

- more east-west transit service across the study area;
- a transit link between the TMC and the Rice Village area;
- a remote parking and shuttle service for Hermann Park and the Museum District; and
- more park-and-ride routes serving the TMC.

East West Access

One of the most commonly identified transit network deficiencies in this area of Houston is a lack of east-west (crosstown) bus service connecting the TMC area with east and southeast Houston. Importance is due to the number of existing and potential TMC employees residing in east and southeast Houston. This connection will also become more important after the CBD-Dome LRT line starts operating because crosstown service will act as a feeder/distributor for the LRT line.

Part of the challenge of providing east-west transit access is the lack of east-west road network continuity. Within the study area, only the following streets provide a direct connection between the east side of the South Freeway and the CBD-Dome LRT corridor:

- Richmond / Wheeler,
- Blodgett,
- Southmore,
- Bissonnet/Binz/Calumet,
- MacGregor/Braeswood,
- Old Spanish Trail/Holcombe,
- Holly Hall/Corder,
- IH-610, and
- Bellfort.

Currently, east-west transit access between the CBD-Dome LRT corridor and the area east of the South Freeway is provided along the following corridors:

- IH-610/Bellfort (via 73 Bellfort),
- Holly Hall (via 87 Yellowstone),

- MacGregor (via 60 South MacGregor and 68 Brays Bayou),
- Old Spanish Trail (via 26/27 Inner/Outer Loop), and
- Southmore (via 60 South MacGregor).

The majority of trips between east and southeast Houston and the TMC area must transfer either downtown or at one of the east side transit centers (generally Eastwood Transit Center at Lockwood and the Gulf Freeway or Southeast Transit Center at Scott and Old Spanish Trail).

Figure 3 shows existing routes providing east-west connectivity between the CBD-Dome LRT corridor and the east side of the South Freeway.

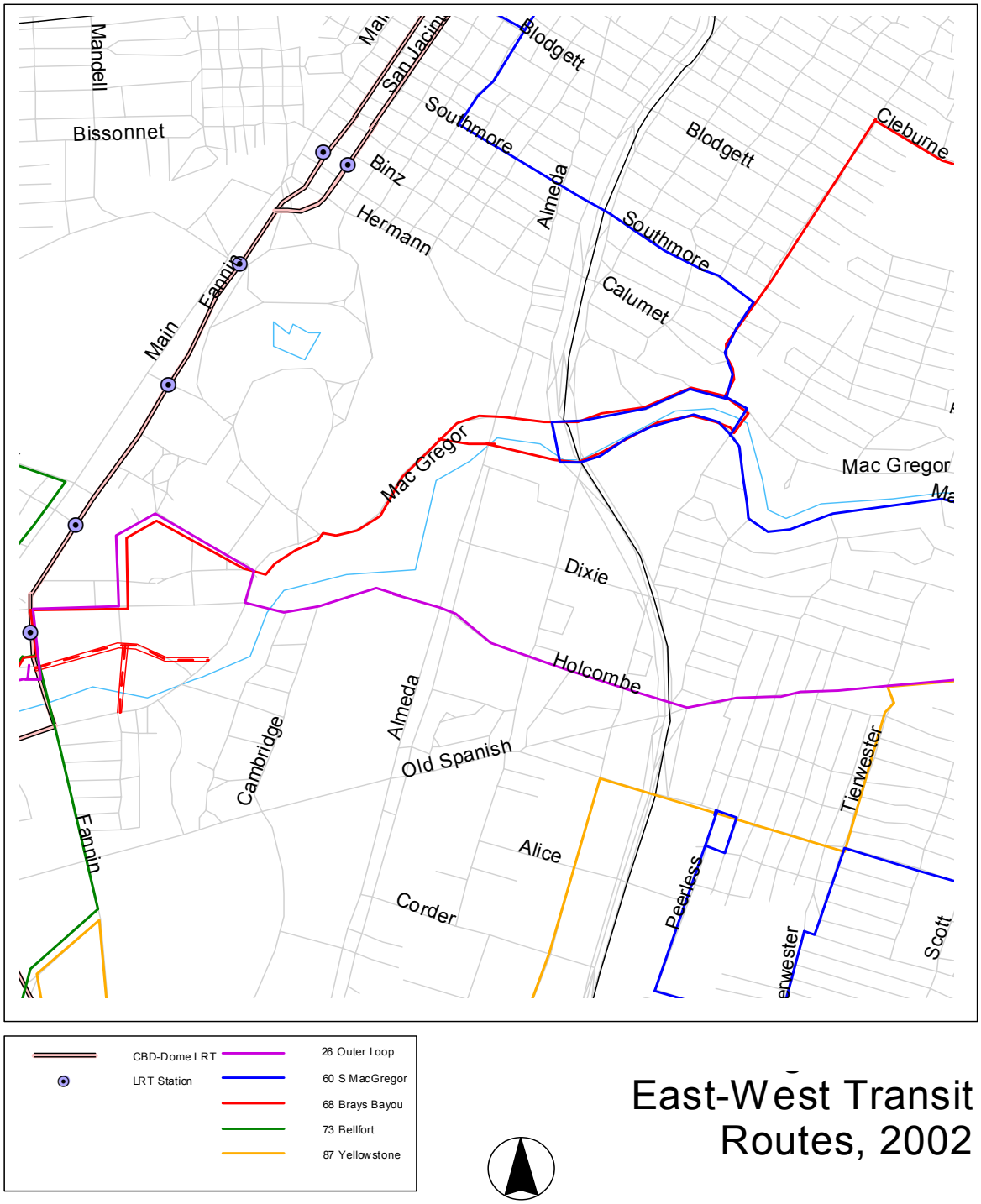

Mandell
Bissonnet
San Jacinto
Blodgett
Southmore
Binz
Hermann
Almeda
Blodgett
Cleburne
Southmore
Calumet
Main
Fannin
Mac Gregor
Mac Gregor
Dixie
Holcombe
Almeda
Cambridge
Old Spanish
Fannin
Alice
Corder
Peerless
Tierwester
Scott
CBD-Dome LRT
LRT Station
26 Outer Loop
60 S MacGregor
68 Brays Bayou
73 Bellfort
87 Yellowstone
East-West Transit
Routes, 2002

Figure 3.2.1.1

East-west service to the west of the study area is more complete, reflecting a street network that is closer to a grid system. Transit service operates between the IH-610 West Loop and the CBD-Dome LRT corridor on the following streets within the study area:

- Richmond (25 Richmond),
- Southwest Freeway/Westpark (17 Gulfton, 132 Harwin Express),
- Bissonnet (65 Bissonnet),
- University (70 University to Stella Link, 73 Bellfort to Buffalo Speedway),
- Holcombe/Bellaire (2 Bellaire, 68 Brays Bayou to Buffalo Speedway), and
- Braeswood/Beechnut (4 Beechnut, 8 South Main to Buffalo Speedway, 68 Brays Bayou).

The only major arterial in the study area that does not have westbound bus service from the CBD-Dome LRT corridor is Old Spanish Trail.

Rice Village Access

Stakeholders are interested in a transit service linking the Rice Village with the TMC area. A suggestion is to operate it like the downtown Trolley routes, using small, distinctive vehicles and high frequencies during lunch and after-work hours.

Stakeholders identified a desire among TMC workers to travel to the Rice Village for lunch trips, and possibly for after work shopping or entertainment trips. It is felt that because parking is limited and in some cases distant in both the Rice Village and the TMC areas, an effective transit service might be able to compete with private automobile use.

Any proposed circulator service operating between the TMC and Rice Village would have to overcome the following challenges to be successful:

- Service would partially duplicate an existing route operating between the TMC and the Rice Village, the 73 Bellfort.
- The new Commons building under construction in the TMC will include multiple new lunch opportunities for TMC employees.
- Outside of holiday periods, parking and traffic congestion in the village after working hours is not as severe as during lunch periods.
- Most TMC employees have limited lunch periods, often at non-standard times.
- There may be neighborhood opposition to increasing bus volumes on University Boulevard, which is the most direct roadway link between the TMC and the Rice Village.
- Circulation within the Rice Village area will be adversely affected by traffic congestion and, in some cases, very narrow streets.

Remote Parking for the Museum District and Hermann Park

Stakeholders identified a need for remote parking and shuttle service for Hermann Park and the Museum District, especially in conjunction with major events.

During peak periods (holidays, weekends, and during events at Miller Outdoor Theater), Hermann Park experiences severe traffic congestion on internal roads, and parking demand exceeds capacity. There is currently no overflow parking provided except on the streets of adjacent neighborhoods. Similarly, institutions in the Museum District have limited parking, and historically have relied upon Hermann Park's internal roadways and adjacent neighborhoods for overflow parking.

Neither Hermann Park nor the Museum District has any concrete plans to build additional parking capacity within Hermann Park, although the Hermann Park transportation plan Contemplates additional parking on the north or south sides of the park.

During peak periods, one potential solution is to link Hermann Park and the Museum District with off-site, remote parking. Several locations have been suggested, including:

- TMC parking lots, particularly Smithlands and South Extension;
- Reliant Park parking lots when there is not an event taking place;
- METRO Park & Ride lots, especially the planned Fannin Park & Ride lot;
- The Houston Livestock Show and Rodeo's remote parking near the South Freeway on Reed Road;
- Existing private parking facilities in downtown and midtown ;
- Rice University stadium parking lot;
- Southeast corner of Braeswood and Holcombe;
- Memorial Hermann Hospital lot on the south side of MacGregor;
- Nabisco Building lot;
- Surface lot on the southwest corner of Shamrock and Main; and
- Stadium parking at Rice University.

Each of the suggested parking locations has advantages and disadvantages. In all cases, remote parking would require a substantial public education effort to teach people where to look other than within the park for parking spaces. New signage would need to be installed, preferably signs that can be changed to reflect changes in where capacity exists at a given time.

One potential solution to the parking capacity problem is the CBD-Dome LRT line. The line connects Hermann Park with several potential off-site parking lots, including the Fannin South Park & Ride, Reliant Park, the Smithlands, and private parking lots in the downtown and midtown areas.

Currently, Reliant Park and the TMC do not allow public parking at Reliant Park or the Smithlands. A policy by which parking would be provided for a fee would need to be developed. Preferably, the parking payment would include train fare so patrons would only have to pay once. Lack of available capacity might also be an issue at some times.

Other potential parking locations, such as the Rice University stadium lot and the new Rodeo lot at Reed Road, also do not allow public parking. In addition to changing parking policies, new shuttle service would have to be created from these locations as they are not located on existing bus lines or on the CBD-Dome LRT line.
Most METRO Park & Ride locations have excess parking capacity on weekends when Hermann Park and the Museum District experience their peak periods. However, the lots have limited transit service at these times. New services would have to be created and funded to allow use of these lots. Such service would need to be tailored to the schedules of major events.

Park & Ride Service
Some stakeholders believed that there should be additional Park & Ride service to the TMC. Table 4 shows the existing express and Park & Ride routes that currently serve the TMC.

TABLE 4: Existing Express and Park & Ride Service to the TMC

Route	P&R Lots Served	Hours of Operation	Weekday Ridership (2001)
170 Missouri City	Missouri City	M-F 5:30am-7:25pm	600
291 Kuykendahl-North Shepherd	Kuykendahl North Shepherd	M-F 4:57am-6:33pm (Peak Only)	513
292 West Bellfort-Westwood	West Bellfort Westwood	M-F 5:10am-7:41pm (Peak Only)	382
297 South Point-Monroe	South Point Monroe	M-F 5:13am-7:05pm (Peak Only)	415
298 Addicks-NWTC	Addicks Northwest TC	M-F 5:05am-7:22pm (Peak Only)	550
299 The Woodlands Express	The Woodlands		2,100

Source: METRO, Brazos Transit

In the Proposed Bus Operating Service Plan, METRO plans to eliminate direct Park & Ride service to the TMC. Instead, passengers will take Park & Ride buses downtown and transfer to the CBD-Dome LRT Line (170 Missouri City service will still stop at Fannin Park & Ride).

METRO plans its service cuts because of limited ridership on Park & Ride routes to secondary destinations (destinations other than downtown). Of the six TMC commuter routes, four had a ridership of more than 500 passengers per day. However, all four served major employment centers outside of the TMC (routes 170, 291, and 299 serve downtown; Route 298 stops at the Northwest Transit Center in the Uptown Area). None of the four recorded more than 500 Medical Center area boardings per day.

Brazos Transit operates Route 299. Brazos Transit has no plans to modify or eliminate Route 299 at this time.

3.2.2 Observations by the Study Team

Field work was conducted in the TMC area in February and March of 2002. Field work included driving and walking around the TMC area and discussing transit issues with representatives of METRO Service Planning. Based on field work, the following transit system deficiencies were identified, in addition to those already identified above:

- internal circulation in the TMC area after the CBD-Dome LRT line and TMC Transit Center open,
- connection between the regional High Occupancy Vehicle (HOV) network and the TMC,
- buses are adversely affected by traffic congestion in the TMC area,
- bus volumes are very heavy on South Main Street, and
- pedestrian infrastructure does not connect with transit stops in some areas.

Expanded Circulators

Following the opening of the CBD-Dome LRT Line, transit service in the TMC area will be focused on the new TMC Transit Center, located on Fannin Street between Galen and Holcombe. All routes passing through the TMC area will stop at the transit center. The transit center will have a LRT stop and will be the route end location for the 2 Bellaire, 4 Beechnut, and 15 Hiram Clarke routes.

Because the new transit center will represent the major transit node for the TMC area, the TMC shuttle service will need to be expanded and re-oriented towards the new facility. This will allow transit users to exit their buses or the LRT service at the Texas Medical Center Transit Center and transfer to frequent shuttles serving all parts of the TMC.

The shuttles should also connect with the North MacGregor stop (the northernmost TMC stop) so patrons needing to get to the north end of the TMC do not have to ride all the way to the transit center on the south end.

METRO has proposed an expanded circulator system. This system is still in development. Figure 4 shows the most recent iteration of the METRO shuttle plan.

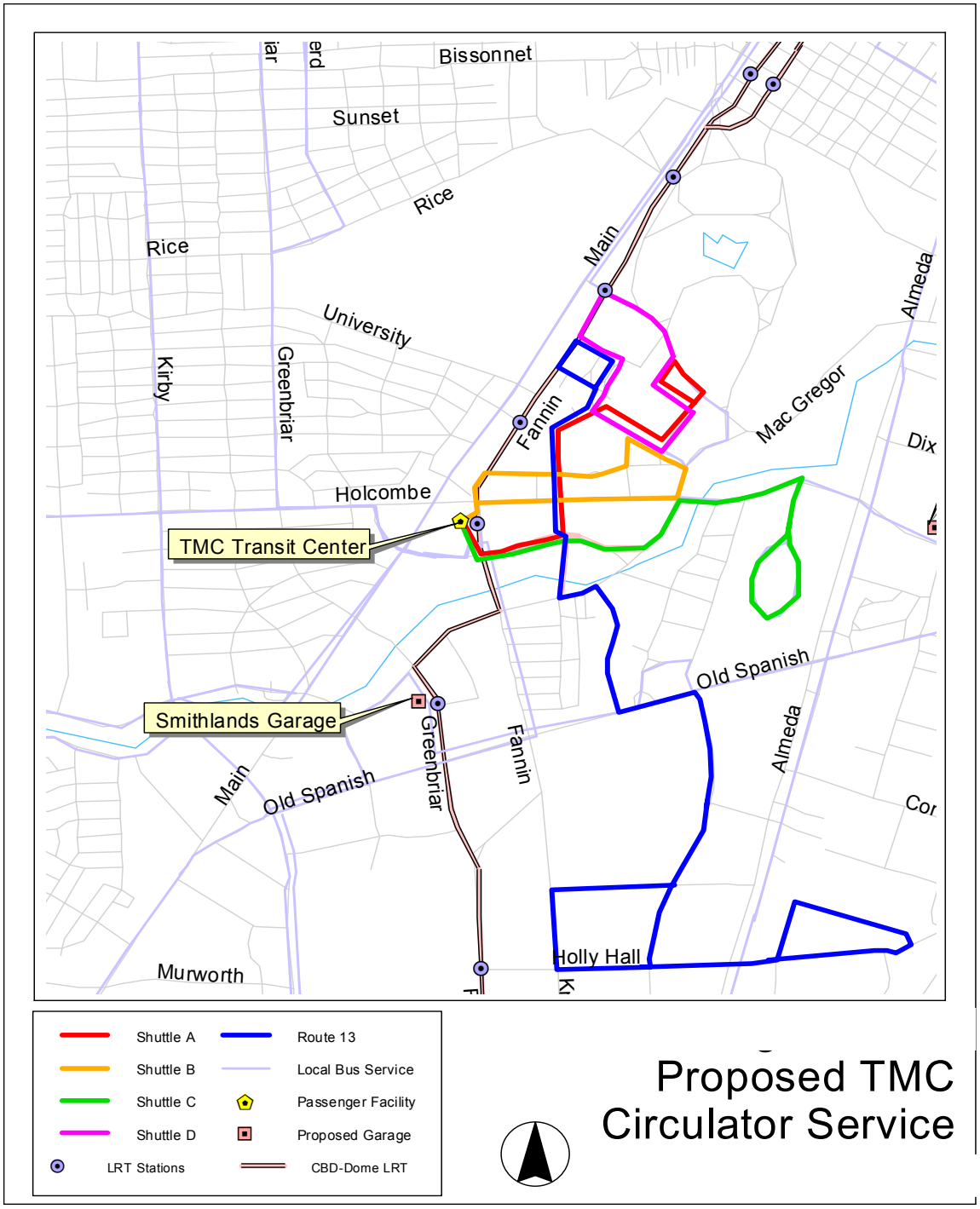

Bissonnet
Sunset
Rice
Rice
Main
Almeda
University
Kirby
Greenbriar
Fannin
Mac Gregor
Dix
Holcombe
TMC Transit Center
Old Spanish
Smithlands Garage
Greenbriar
Fannin
Almeda
Main
Old Spanish
Holly Hall
Murworth
Shuttle A
Shuttle B
Shuttle C
Shuttle D
LRT Stations
Route 13
Local Bus Service
Passenger Facility
Proposed Garage
CBD-Dome LRT
Proposed TMC
Circulator Service

Figure 3.2.2.1

HOV Access

METRO has constructed an extensive network of HOV lanes across the Houston area. These HOV lanes allow transit vehicles and carpools to bypass congestion for trips to the downtown area or Uptown, as well as to some outlying activity centers. However, neither of the expressways in the TMC area (the South Freeway and the South Loop Freeway) currently has any kind of HOV facility.

The lack of any HOV or priority facilities for buses means that buses do not enjoy any of the time savings over single-occupant vehicles enjoyed in corridors with HOV lanes. As a result, transit use is not as competitive with private vehicles for choice riders.

There are also no priority treatments for buses on arterials connecting the TMC with regional expressways. Priority treatments typically are markings in the curb lanes on major arterials limiting use to transit vehicles and right turns.

METRO has identified the South Freeway as a candidate for future High Capacity Transit, which could include an HOV facility. In addition, other treatments to expedite bus movement are possible.

Traffic Congestion Affecting Bus Operations

During peak periods, there is localized traffic congestion that affects transit efficiency at several locations in the TMC area. Some locations include:

- Holcombe between Braeswood and Kirby Drive,
- South Main Street between North MacGregor and Greenbriar,
- Fannin between Galen and North MacGregor, and
- South Freeway frontage road between Yellowstone and Holcombe.

Congestion also occurs during special events, such as in Hermann Park on weekends, around Rice University when there is a concert or football game, and around Reliant Park before and after football games or other events.

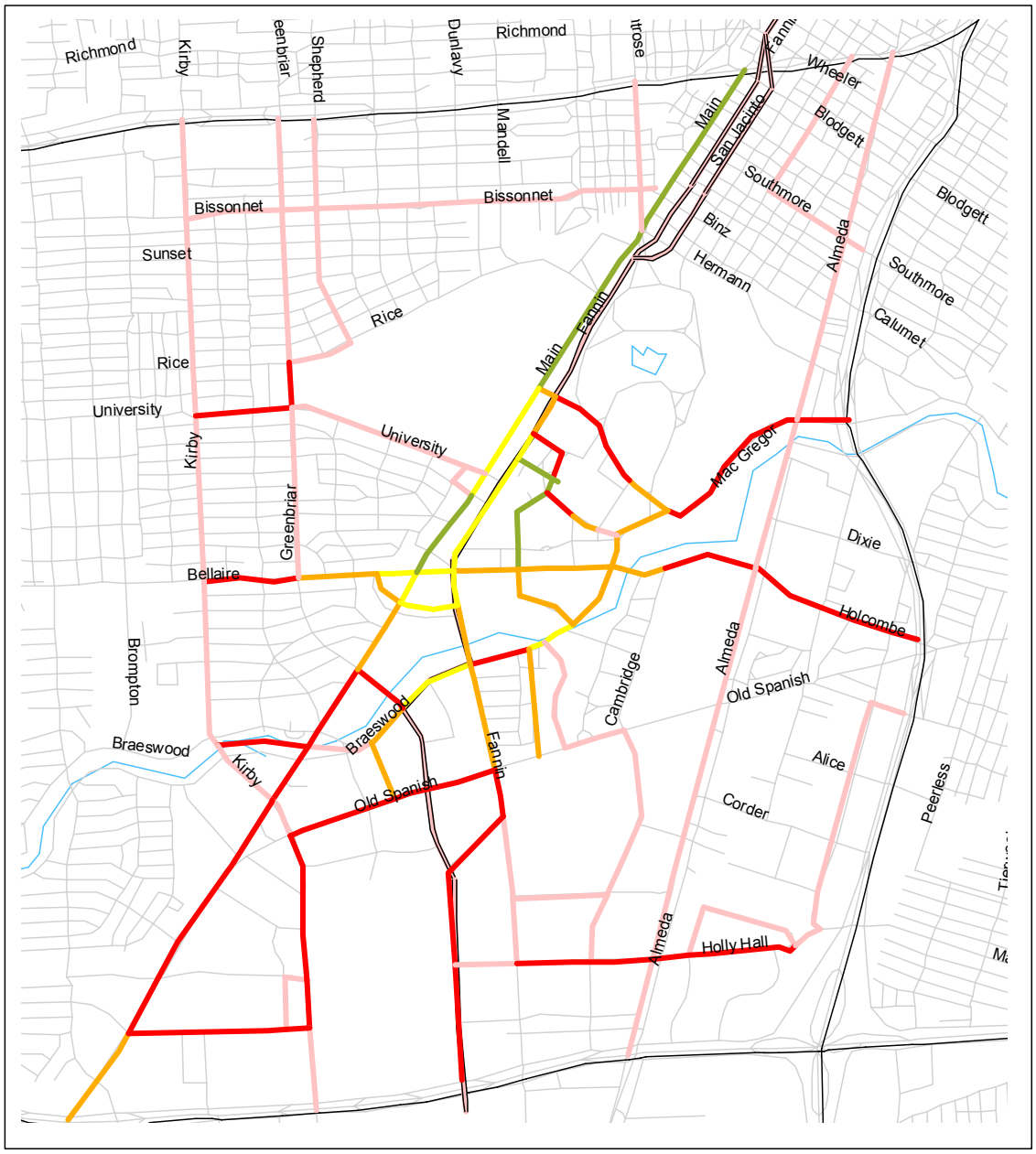
Because buses operate in the same roadways as general traffic, they are affected by the same congestion. In some ways, buses are more adversely affected than other vehicles, because they cannot leave their routes to avoid traffic congestion. Hence, improvements that would expedite traffic flow in these locations could also expedite transit movement.

Bus Volumes

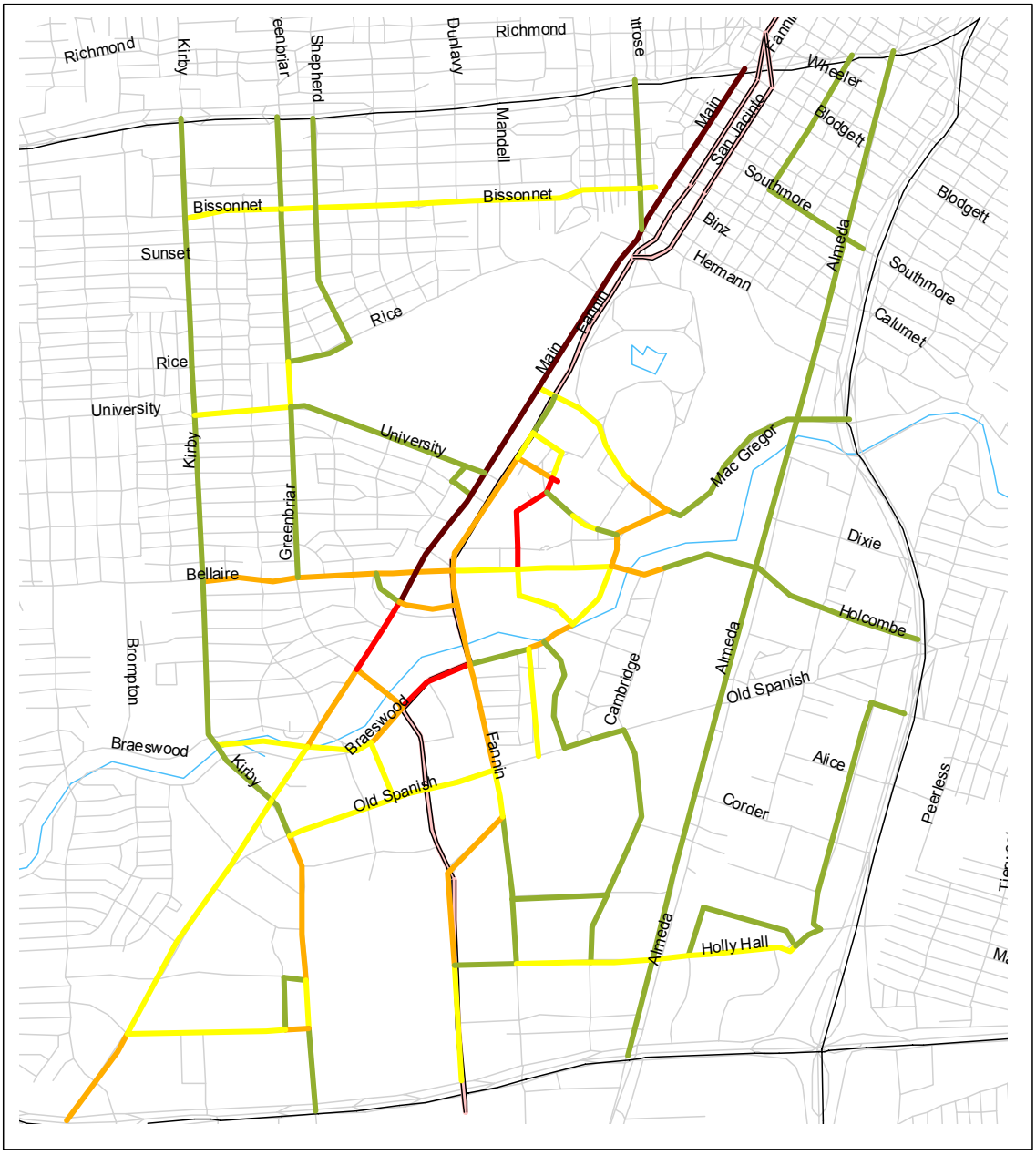
Prior to the commencement of the Fannin Street reconstruction project in 2000, the majority of local and through bus traffic in the TMC area operated on Fannin Street. Subsequent to the beginning of construction on Fannin, the majority of bus service has been relocated to South Main Street in the TMC area.

Figures 5 and 6 show bus volumes on streets in the study area in using METRO March 2002 routes and schedules. The bus volumes reflect the relocation of several routes to South Main Street from Fannin Street. Following the opening of the CBD-Dome Light Rail Transit (LRT)

line in early 2004, through buses in the TMC area will be eliminated, and routes will instead truncate at the planned TMC Transit Center (applies to the 2 Bellaire, 4 Beechnut, 15 Hiram Clarke, 170 Missouri City). Routes with local service in the area (1 Hospital, 8 South Main, 34 Montrose, and 73 Bellfort) will operate on South Main Street.



AM Peak Period Bus Volumes, 2002



Midday Period Bus Volumes, 2002

Pedestrian Infrastructure

All transit users are pedestrians for at least some part of their journey. A successful transit network requires a supporting network of pedestrian ways, such as sidewalks and trails. Where sidewalks are lacking or are in poor condition, walking to transit stops or waiting for buses can be unpleasant or dangerous. Some intersections are also unfriendly to pedestrians. For persons with disabilities, getting to bus stops can be impossible. Pedestrianways and street crossings should conveniently connect each generator of trips with transit stops.

3.3 Parking

The needs assessment for parking is based on results from the stakeholder interviews, previous studies, and observations by the study team.

3.3.1 Stakeholder Interviews

The following are some of the key needs identified through the stakeholder interviews:

- There is an imbalance with regard parking supply versus demand at the major activity centers, especially Hermann Park, Rice University, TMC, and Reliant Park.
- The proximity of parking to Light Rail Stations is a concern, particularly to balance peripheral versus remote parking.
- There are regular parking overflow problems north of the Rice Campus and west of TMC.
- Hermann Park regularly experiences parking overflows on nice weekends and special event days. There is a need for 400 additional spaces, based on the results of a 2000 parking charrette that was convened.
- Given the extent and locations of parking and the diverse demand characteristics in the area, there is potential for shared parking.

3.3.2 Needs at activity centers

The following are some of the key parking needs identified by the study team for the main activity center areas:

- Rice University.
  With recent campus and parking development, Rice is now in the process of examining its parking needs and reconsidering parking policies. Rice obviously needs an appropriate supply, price/permitting policies, and location of parking to avoid on-street parking neighborhood impacts. The supply policies of Rice and TMC (meet parking demand) should be consistent with neighborhood concerns about on-street parking. The close proximity of Rice, the TMC Main Campus, and Hermann Park, each with large parking demands but with different temporal characteristics, may present an opportunity for shared parking. Event parking (and traffic) may also be an issue to be considered. Impacts on curb parking in adjacent neighborhoods should also be considered.

- Hermann Park/Zoo
  Weekend and holiday parking demands tend to overwhelm park facilities. Parking and circulation problems result. A 2000 parking charrette identified the need for about 400 additional spaces plus some replacement spaces just to meet typical demand levels. A

need was also identified for a further 200 to 400 additional spaces to be provided in future to cater for increased attendance generated by new programs and growth in the area population.

Remote parking with transit access made available on weekends could be a partial solution. If provided, structured parking near Memorial Hermann and Ben Taub Hospitals north of North MacGregor Way could be shared on a day of week basis to relieve weekday parking demand at TMC and peak park demand on some evenings and weekends.

- Museum District

  The South Main Center Association and Houston Museum District Association have identified the need for additional parking within the Museum District. To facilitate the creation of adequate parking, partnerships will have to be formed between the various institutions located within and adjacent to the Museum District. Through these partnerships land can be purchased and parking structures built for the purposes of shared parking between the various stakeholders. Parking could be shared among multiple institutions and Hermann Park.

- TMC Main Campus

  The TMC Main Campus benefits from the operation of TMC garages and a unified parking policy (a summary of this policy is contained in the Appendix B). The parking ration supplied for new construction will be very important in accommodating parking needs.

  Additional important parking-related issues on campus seem to be wayfinding and good clear routes between the medical center buildings and the garages. The integration of a comprehensible pedestrian network (at-, above-, and below-grade) into campus redevelopment is essential. Even with skyways and tunnels, at-grade movements should be accommodated through good design features.

  Campus re-development also needs to address all demands for loading and service deliveries. Attention should be given to the use of the internal street system on campus. The capacity of this system is a precious resource that needs to be preserved for the most essential uses. The internal street system provides a structure to the campus that is essential for transit, service, pedestrian, and bicycle movements.

- Other Campus Districts and Off-Campus Development

  Other districts should be self-sufficient with respect to parking. The need to travel between districts should be accommodated, to the extent possible, by transit, bicycle, and pedestrian facilities (depending on distance) so that automobile trips between TMC Area districts and between neighborhoods (intra-area) are kept to a minimum.

- Reliant Park

  The event nature of Reliant Park activities requires an extensive parking supply. Approximately 25,000 spaces will be in place once the current construction and

demolition program is competed. This includes 5,000 spaces leased to Six Flags Astroworld through the middle of this decade. The full supply is estimated to be sufficient to meet Reliant Park needs. Additional parking may be needed if facilities in the park are expanded. Structured parking and improved IH-610 and SH 288 access can improve event traffic patterns and facilitate the use of Reliant Park parking to serve other TMC-area uses via transit connections. Operational planning should be in place to direct circulation and parking activities during major events and address impacts on all other areas and neighborhoods.

3.4 Pedestrians and Bicycling

3.4.1 Stakeholder Interviews

The following needs were identified through the stakeholder interviews:

- Safety concerns

  Pedestrian and bicycle concerns identified by stakeholders and the study team include:
  - Rice and TMC streets and crossings
  - Pedestrian crossings at the following locations:
    - Holcombe
    - Fannin (Light Rail Stations)
    - Mecom Fountain
    - Greenbriar at Rice
    - Main at MacGregor

  These locations are difficult to cross safely.

- Bicycle amenities

  The following needs were identified:
  - Provide secure parking, showers, lockers at major destinations
  - Provide unimpeded trails along Brays Bayou (use bridge underpasses)
  - Modify Southmore, MacGregor and OST/Holcombe bridges over SH 288 to make them more pedestrian and bicycle friendly
  - Improve the trails along Almeda in Hermann Park
  - Bikeway path to extend north along Cecil Street from Old Spanish Trail to Herman Pressler Street.

- Wayfinding

  The study area street system is a convergence of different grids and angle streets. There are also discontinuities in the street system at Brays Bayou, Hermann Park, Reliant Park, Rice University, and IH-610 and SH 288. Some streets extend only a short distance. As a result, the street system as well as pedestrian and bicycle routes and facilities are hard top comprehend in some areas. Those unfamiliar with the area, such as visitors to the museums, TMC hospitals, etc. have a hard time finding their destinations, parking, and walking routes. A wayfinding system was identified as an important need for the area. Signage is needed for travelers by all modes to facilitate reaching principal destinations and parking from primary approach routes.

3.4.2 Additional Pedestrian Needs

Pedestrian sidewalks, handicap ramps and marked crossings should be provided throughout the TMC to ensure pedestrian safety and to provide for increased mobility options. Special attention should be given to pedestrian crossings at major thoroughfares with both high pedestrian and vehicular volumes. Currently, the TMC has a significant amount of pedestrian activity occurring all throughout the area. With expansion of the transit system and additional peripheral parking structures, pedestrian traffic will increase. Streets, intersections, and transit stops should be designed with proper pedestrian amenities such as (street furniture, canopies, lighting, handicap ramps at intersections, and sidewalks).

In 2004 the Metro Light Rail system is planned to provide a connection between the Central Houston Business District (CBD) and the Texas Medical Center area (including as far south as the Astrodome). Proper pedestrian access will need to be maintained at the four (4) Metro rail stations within the TMC campus. A transit center will be located at Galen Station just south of Holcombe Boulevard, which may require additional pedestrian access than that of a typical station. Figure 7 illustrates the various Metro stations within the study area.

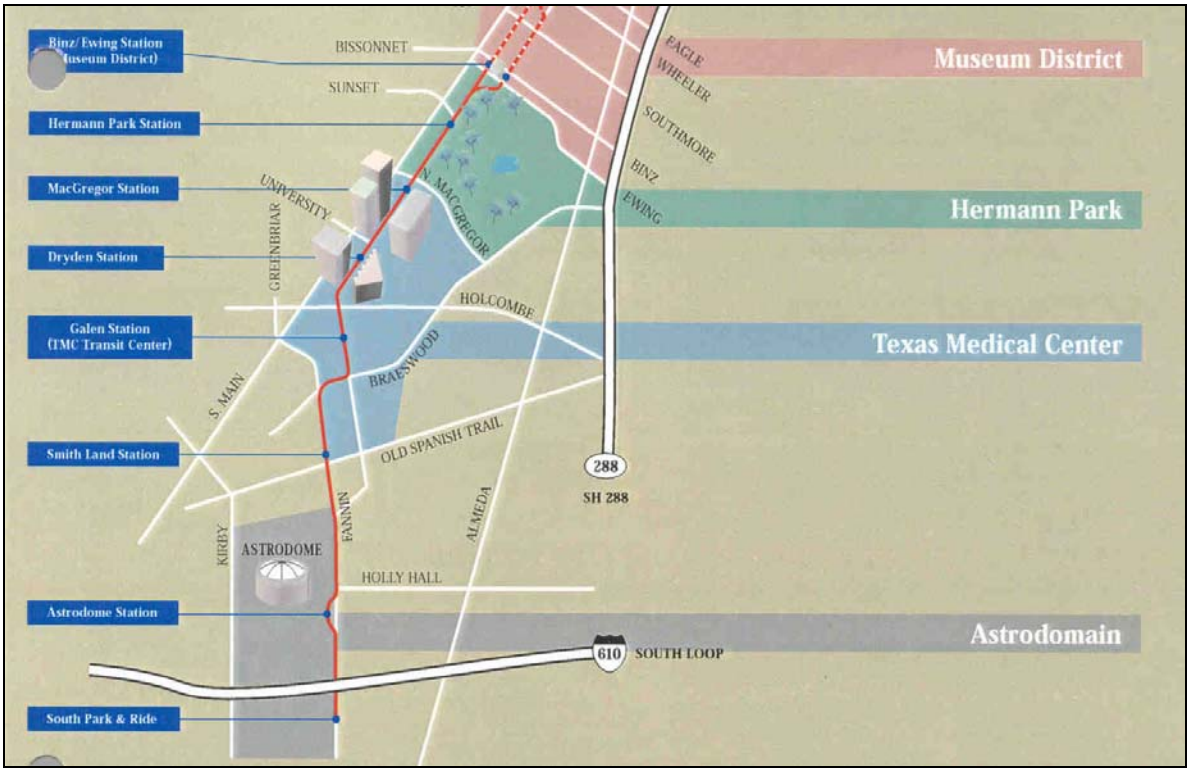
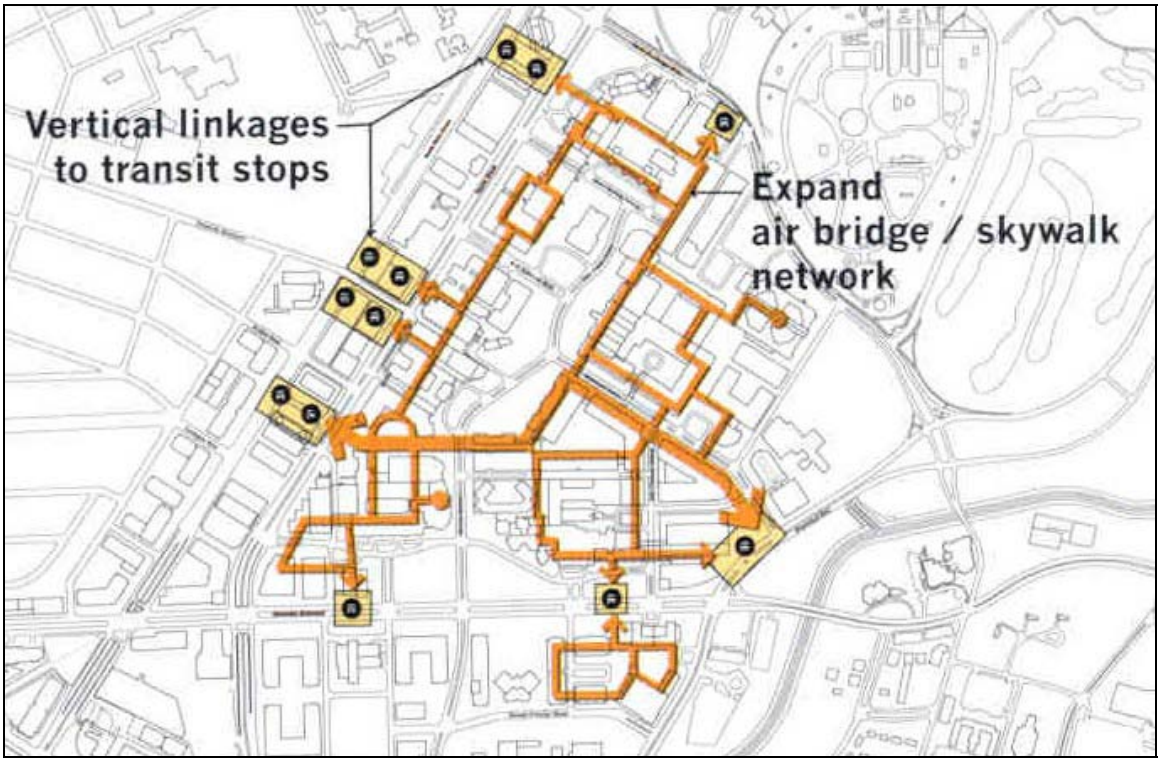


FIGURE 7: Metro Light Rail System

The Texas Medical Center's 50 Year Master Plan includes a skywalk network displayed in Figure 8. Where appropriate, vertical linkages to the skywalk network from the public transit and campus bus stops should be provided. This continuous network of air bridges and skywalks will provide pedestrians with their own facility, reducing the amount of conflict with other modes of

transportation, i.e., automobile and light rail. A connection between these planned skywalks and the proposed light rail station should be created. TMC is currently refining the skywalk system concept.



Source: TMC Master Plan

FIGURE 8: Pedestrian Skywalk Network Concept

4. CONCLUSIONS

This memorandum described current and future needs identified for traffic, transit, parking, pedestrians and bicycles. The needs were determined based on information obtained from reports of previous studies, the study team's observations, and stakeholder interviews.
It is evident that there are a considerable amount of transportation-related needs. Subsequent memorandums will discuss how these needs can be addressed.

APPENDIX A: Stakeholder Interview Summary

A1: Organizations and Individuals Interviewed

Interview number	Organization interviewed	Individuals interviewed
1	Baylor College of Medicine	Bud Jennison
2	City of Houston Parks and Recreation Department	Rick Dewees
3	City of Houston, Planning and Development Department	Anthony Tangwa and Jennifer Ostlind
4	Developer of Southeast Texas Biotechnolgy Park	John Walsh
5	Devonshire Place Neighborhood	Harrell Rodgers
6	Friends of Hermann Park	Roksan Okdan-Vick
7	Harris County Commissioner, Precinct 1	El Franco Lee
8	Harris County Flood Control District	Carol Ellinger, Richard Scott, and Ralph Steiner
9	Harris County Sports and Convention Corporation	Mike Surface
10	Hermes Architects	LeRoy Hermes, Cheryl Gajestic, and Andres Angel
11	Houston City Council Member, District C	Mark Goldberg
12	Houston City Council Member, District D	Ada Edwards
13	Houston Galveston Area Council	Alan Clark and Carolyn Anderson
14	Houston METRO	John Sedlak
15	Houston Sports Authority	Billy Burge
16	J.F. Thompson, Inc.	Jim Thompson
17	Neighborhood Recovery	Paul D. Charles
18	OST/Almeda Corridors Redevelopment Authority, TIRZ#7	Theola Petteway
19	Rice University	Dean Curry and Neill Binford
20	South Main Center Association and Houston Museum District Association	Susan Young
21	Sports Management Group	Richard Booth, Mike Miller, and Carl
22	Texas Department of Transportation	Gary Trietsch and Delvin Dennis
23	Texas Medical Center	Liz Ghrist
24	Traffic Engineers, Inc. (TEI)	Susan Alleman, Roger Armstrong, and Dan Lynch
25	University Place Association including Southgate	Kathy Easterly

Appendix A2: Principal Needs, Issues, and Opportunities Expressed in Interviews

1. Improve access along IH-610 to the TMC area.
2. SH-288 is a barrier that splits a former neighborhood. Cross connections should be provided.
3. There is a need more SH-288 access to the TMC area that is not dependent on IH-610.
4. Congestion along SH-288 poses a problem, especially at the interchange with MacGregor.
5. What will be the impact of the proposed projects on areas to the east of SH-288?
6. The signage along SH-288 and 59 needs to be improved.
7. Flooding in the study area is a major concern for general traffic and particularly for emergency vehicles.
8. Brays Bayou will be enlarged for a length of 17 miles from its mouth all the way to Fondren Street (about 5 miles west of the study area). It includes flood channel widening on one or both sides of the bayou.
9. In the study area a total of 9 bridges are affected. Bridges to be replaced include Ardmore, SH-288, Almeda, S. Braeswood, Fannin, Greenbriar, S. Main, and Kirby. Whereas bridges at Holcombe, and Buffalo Speedway need to be lengthened. The TMC might take advantage of the opportunity to build a number of signature bridges or to move the location of some of these bridges.
10. Kirby, MacGregor, and Main are seen as city improvement priorities in conjunction with flood control. Kirby will be reconstructed south to IH-610.
11. SH-288 will be reconstructed over Brays Bayou in order to raise the bridge.
12. A large Biotechnology Park is planned for the area south of Old Spanish Trail, between Knight and Cambridge.
13. Baylor College of Medicine owns the Parkwood apartments. They will make a business decision regarding the desired use for this property. It is highly likely that it would be biotech related and that it would blend in with the BioHouston development. Possible housing for students is being considered in addition to the biotech facilities. The vision for the property is fairly low-rise buildings (less than 6 stories) having approximately 2 million square feet in total.
14. The TMC sees the need for 1 or possibly 2 new trauma centers. The location of these centers is of prime concern. They should be highly accessible, yet integrated with the current facilities of the TMC.
15. The Astroworld's site is a possible area for expansion of Reliant Park.
16. Greenbriar and Shepherd south of US 59 experience traffic speeds that are far too high for a residential area.

17. The completion of West Bellfort to US 59 requires a road to be built between Stella Link and Buffalo Speedway. This would increase traffic through the neighborhood west of Stella Link, which is opposed by neighborhood.
18. Access to Reliant Park needs to be improved.
19. There is a need for east-west transit connections through the study area. In particular, connections that can tie in with the light rail stations.
20. There is a need for a monorail or equivalent type of people mover in the TMC area.
21. The Almeda corridor will be redeveloped between Binz and US-59. The planned re-development involves mostly commercial redevelopments, some new housing units, and the reconstruction of Almeda Street. The redevelopment authority desires to reduce the traffic emphasis of Almeda to a minor thoroughfare.
22. There is a need for improved east-west connections along the South Main street corridor.
23. Pedestrian movements between light rail stations and the hospitals and across Fannin Street pose safety hazards.
24. Pedestrian access to and around Mecom Fountain is very dangerous.
25. The Greenbriar/Rice Blvd. intersection is too difficult for pedestrians to cross.
26. There is a need for additional parking at the museum district.
27. There is a problem with parking that overflows into the neighborhood at Rice University.
28. Cost of implementation of transportation improvements to be included in this master plan will be an issue as will where funding will come from.

Appendix A3: Projects Suggested in Interviews

1. Provide IH-610 interchanges with Almeda and Cambridge.
2. Improve traffic flow through the SH-288/IH-610 interchange by providing continuous frontage roads
3. Provide an HOV facility in the median of SH-288.
4. Consider a direct flyover from IH-610 to/from Reliant Park (preferably to a parking garage).
5. Provide direct freeway access ramp(s) between IH-610 and Main.
6. Sign US 59 exit ramps at Main/Fannin as THE exits to TMC to relieve Greenbriar/Shepherd.
7. Extend Cambridge Street to North MacGregor and widen it between Holcombe and to Old Spanish Trail.
8. Extend Bertner Avenue across Brays Bayou.
9. Complete of Hermann Pressler Drive.
10. Reconstruct McNee with curb/gutter section.
11. Provide a people mover along Bertner Avenue between the planned Biotechnolgy Park and TMC garage #2 to alleviate some traffic and parking problems.
12. Provide a shuttle service between TMC and Rice Village.
13. Provide bike paths along Brays Bayou for commute trips to TMC.
14. Improve hike and bike trails along Almeda.
15. Provide secure bike parking at TMC institutions (and maybe showers/lockers).
16. Consider the closure of Murworth during major Reliant Park events so pedestrians can use it.
17. Improve intersections of Holcombe/South Main, Holcombe/Fannin, Main/University, Rice/Sunset, and Main/MacGregor.
18. US 59 eastbound exit ramp to Main Street will feed a lot of traffic to Southbound Main Street. This will need a special right turn treatment to handle volume (maybe provide exclusive lane added to southbound Main after light rail line has turned off Main).
19. Main Street should carry more traffic with increased US 59 access. Signals should be progressive to encourage use of Main rather than having traffic filter on to adjacent streets.
20. Implement various traffic management solutions.

APPENDIX B: Texas Medical Center – Parking Policies

The following parking principles are defined in the Texas Medical Center 50 Year Master Plan.

General Parking Principles

- Promote public transit to reduce parking demand
- Set garage capacity to ensure a contingency of spaces to meet peak operating demands
- Use shading on surface lots and garage roofs to ensure maximum utilization
- Own, operate or manage parking as joint venture with individual institutions, with dedicated parking
- New developments must provide parking spaces in accordance with the Parking Management Area plan in effect (currently 1.8 spaces per 1,000 s.f. of building area).

Main Campus Parking

- Provide patient, visitor, designated staff and community doctor parking at the most accessible locations within parking structures and lots
- Incorporate below-grade parking into all new development or provide comparable capacity elsewhere
- Reduce existing number of contracts at garages and lots in the Main Campus to provide 4,000 spaces for visitors and patients
- Build new parking capacity in the Main Campus to meet future parking demands and as a long term replacement for Garages 1, 2, and 5

Visitor and Patient Parking

- Prioritize location of visitor and patient parking
- Make visitor parking easily accessible form major streets and in close proximity to institutions
- Provide appropriate and meaningful wayfinding aids for visitors
- Dedicate an appropriate percentage of spaces to visitors at surface lots and garages
- Provide visitor parking within a 6-minute walk for each institution

Peripheral Parking

- Strengthen and improve shuttle service connections from peripheral lots to institutions
- Develop a direct point-to-point shuttle system
- Acquire peripheral land to be used for parking in the short term and for development in the long term
- Consider structured parking in the long term at Smith Land for remote use and combine with amenities such as daycare, shopping and personal services

Implementation

- Free up land in the Main Campus for future development by removing existing surface parking and phasing out older parking structures in the long term
- Implement a combination of strategies in five year phases to meet parking requirements
- Increase public transit ridership in each phase in order to have a large impact on reducing the total parking required